Center for Independent Experts (CIE) Independent Peer Review Report

Stock Assessment Review (STAR) Panel for Darkblotched Rockfish and Petrale Sole

Seattle, Washington. May 13-17, 2013

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Executive Summary

The stock assessment indicated that Darkblotched rockfish was at 36% of its unexploited level in 2013. This is above the overfished threshold of SB25% but below the management target of SB40% of unfished spawning output. The science reviewed is the best scientific information available at present and that this new assessment constitutes the best available information on Darkblotched rockfish off the U.S. west coast.

The stock assessment indicated that Petrale sole was at 22% of its unexploited level in 2013. This is slightly below the management target of 25%. The stock was not overfished in 2012. The 2012 1-SPR is 60% which is less than the 1-SPR-based management fishing mortality target of 70%. The science reviewed is the best scientific information available at present and that this new assessment constitutes the best available information on Petrale sole off the U.S. west coast.

Background

The Stock Assessment Review (STAR) Panel for Darkblotched rockfish and Petrale sole was held in Seattle, Washington from 13-17 May 2013. The purpose of the meeting was to provide technical review of: (1) the benchmark assessment conducted for Darkblotched rockfish, a species declared overfished and currently managed under a rebuilding plan. The 2013 assessment update for this stock encountered dramatic changes in stock structure, as observed by the west coast bottom trawl survey; (2) the benchmark assessment for Petrale sole, a species declared overfished and currently managed under a rebuilding plan. The benchmark assessment was required to accommodate a restructuring of the model's catch data.

The Panel was composed of two independently appointed Center for Independent Experts (CIE) reviewers (Dr. N. Cadigan, Canada; Dr. Y. Jiao, USA), an independent reviewer from the International Pacific Halibut Commission (Dr. I. Stewart) and an independent chair (Dr. Tien-Shui Tsou, USA) of the Pacific Fishery Management Council's (PFMC's) Science and Statistical Committee (SSC). The SARC was supported and assisted by Mr. J. DeVore (PFMC. Assessment documents were prepared by stock assessment teams (STAT's) and presented by Dr. V. Gertseva (NWFSC) for Darkblotched rockfish and Dr. M. Haltuch (NWFSC) for Petrale sole. The support of all of these scientists and staff to the STAR Panel process is gratefully acknowledged.

The CIE reviewers were tasked with conducting impartial and independent peer reviews in accordance with the SoW and ToRs herein. The reviewers were required to be active and engaged participants throughout panel discussions and to voice concerns, suggestions, and improvements while respectfully interacting with other review panel members, advisors, and stock assessment technical teams. The CIE reviewers were required to have excellent communication skills in addition to working knowledge and recent experience in fish population dynamics, with experience in the integrated analysis modeling approach, using age-and size-

structured models, use of MCMC to develop confidence intervals, and use of Generalized Linear Models in stock assessment models. Each CIE reviewer's duties were not to exceed a maximum of 14 days to complete all work tasks of the peer review described herein.

Role of reviewer

All assessment documents and most supporting materials were made available to the Panel via an ftp server two weeks before the meeting. These documents are listed in Appendix 1. I reviewed the backgrounds documents I was provided. I attended the entire STAR Panel review meeting in Seattle, Washington, May 13-17, 2013. I reviewed presentations and reports and participated in the discussion of these documents, in accordance with the SoW and ToRs (see Appendix 2). This report is structured according to my interpretation of the required format and content described in Annex 1 of Appendix 2. After the meeting I participated in email discussions dealing with the review panel report and CIE reports.

Summary of findings

I did not have the final assessment document for Darkblotched rockfish.

A. **Darkblotched rockfish**

ToR 1. Become familiar with the draft stock assessment documents, data inputs, and analytical models along with other pertinent information (e.g. previous assessments and STAR panel report when available) prior to review panel meeting.

A draft stock assessment document was provided, including

- a detailed Executive Summary,
- some basic information on stock structure and distribution, basic life history information, and a little ecosystem information,
- a good description of the history of rockfish management,
- a detailed description of fishery landings (directed and bycatch) and discards,
- information on the biological sampling of the catches (lengths, weights, ages),
- fisheries independent survey information (catch rates, length and age compositions),
- other biological information (weight-length relationship, maturity schedule, fecundity, natural mortality, aging bias and precision),
- a detailed history of stock assessment modeling approaches and responses to the 2007 STAR panel recommendations,

- Assessment model description, including changes made from the last assessment, model specification (life-history, stock-recruit, fishery and survey selectivity),
- Model selection and evaluation (key assumptions and structural choices, convergence diagnostics, base model results, uncertainty and sensitivity analyses),
- Description of reference points,
- Text on regional management considerations,
- Research needs,
- Literature cited, and
- Appendices describing: A) timing of management shifts related to West Coast groundfish species, and B) assessment model files (data inputs, model controls, and forecast specifications).

Previous stock assessment documents

The 2007 benchmark assessment document was provided (see Appendix I) as well as the 2007 STAR Panel Meeting Report. 2009 and 2011 update assessment reports were provided, along with several PFMC's SSC Supplemental Reports: (1) June 2009 including the update assessment for Darkblotched rockfish; (2) June 2011 including Darkblotched rockfish; (3) November 2011 Supplemental Report to review stock assessments and rebuilding analyses including Darkblotched rockfish.

Data input documents

In addition to the information provided in the draft assessment document, additional data input documents provided were the January 2013 "Data Products for Stock Assessment Authors", a NOAA Technical Memorandum describing west coast bottom trawl surveys, a 2009 document on the California catch reconstruction project, and a 2013 document on Oregon's catch reconstruction project.

Documentation on analytical models

In addition to the information provided in the draft assessment document, a document titled 'Appendix A: Technical Description of the Stock Synthesis assessment program' was provided.

ToR 2. Discuss the technical merits and deficiencies of the input data and analytical methods during the open review panel meeting.

Input data – merits and deficiencies

Landings of Darkblotched rockfish were reconstructed back to 1916, and the assessment assumes a zero catch and equilibrium unfished biomass in 1915. It is meritorious to have such a long time-series of landings, but the uncertainty in the landings has not been quantified. Historically,

Darkblotched rockfish landings have not been sampled at the species level. Landings prior to 1944 were estimated to be low and provide little information about population dynamics.

There was length composition information from landings for the period 1977-2012, and age data were used in this assessment only for the period 2002-2008. The lack of length and more particularly age composition information is an important deficiency in this assessment. It seems to be the main reason why the assessment is uninformative about how high natural mortality (M) and steepness are.

The discard fractions were at times high (upwards to 50-60%), and there is little information about discards prior to 2000; however, they were estimated to be low (~5%). Year specific discard ratios were calculated for 1985, 1986 and 1987 from the "Pikitch" study; however, participation in this study was voluntary and discarding practices may be different in that scenario. The validity of the assessment would be improved if there was some ancillary information (historical interviews, etc.) to support these low historic discard results.

There was length composition information on discards for the period 1986 and 2002-2011. However, length frequency distributions were developed for both sexes combined since there was little sex information associated with length measurements. Age data were available only for 2004 and 2005. If discard fractions are high then it is important to have size and age information on the discards.

Surveys used were:

1. The Alaska Fisheries Science Center (AFSC) triennial shelf survey which was divided into two periods (1980- 1992 and 1995-2004) to account for differences in survey timing and depth coverage. Separate catchability coefficients (Q) were estimated for each time period. This seemed like a reasonable choice to me, and the Q estimates made sense.
2. The AFSC slope survey for 1997, 1999, 2000 and 2001. These years were selected because of their consistent spatial coverage for Darkblotched rockfish.
3. The NWFSC slope survey conducted annually from 1999 to 2002.
4. The NWFSC shelf-slope (combo) survey conducted annually since 2003, and including 2013 The survey consistently covered depths between 55 and 1280 m (30 and 700 fm) and the latitudinal range between 32°34' and 48°22' N.

It was not clear how much of Darkblotched rockfish habitat was covered by these surveys. This species exhibits ontogenetic movement, with fish migrating to deeper waters as they mature and increase in size and age. Survey data exhibited a rapid increase in fish size over the shallowest depths to roughly 300 m. Adults typically are observed resting on mud near cobble or boulders while demersal juveniles are often found on the highest bit of structure in the local benthic habitat. Although not explicitly stated in the document, it was stated during the STAR Panel meeting that larger Darkblotched rockfish tend to be found in areas not accessible to the survey

trawls but accessible to commercial trawls, and this is a major deficiency with these surveys for rockfish.

The length at which fish currently are 50% mature (based on the maturity and growth curves) is about 28cm which suggests that these surveys provide better indices of juveniles than adults. For example the NWFSC shelf+slope survey has a modal selection length of around 22cm.

From Table B.1 in "The 2003 to 2008 U.S. West Coast Bottom Trawl Surveys of Groundfish Resources" it seems Darkblotched rockfish occurred in 17% of tows during 2003-2008. In Table 10 of the assessment report Darkblotched rockfish occurred in 26% of tows. I presume this difference is due to the selection criteria used to define rockfish habitat in the surveys.

The STAT indicated that Darkblotched rockfish growth rates might vary with latitude: "Analysis conducted within this assessment detected continues gradient along the coast in growth parameters, which is common for Sebastes species on the West Coast of the United States". This analysis was not presented so I cannot comment on the potential magnitude of this problem. However, in future plots of length versus age by sex should be provided for at least North and South regions.

The 2011 assessment update reported that the length at 50% maturity was 35cm which implies that age at 50% (A50) maturity was approximately 7 using the Von Bertalanffy growth curve in Figure 42 of the 2013 assessment document. This is greater than the A50 approximately equal to 5 reported in the 2013 document. It was unclear if this represented a change in maturity or a sampling difference. This requires further investigation, particularly in light of the frequently observed decrease in age at maturation that seems to occur when total mortality rates are high.

The fecundity-weight relationships used in the 2011 and 2013 assessments were different, both in terms of scale and to a lesser extent shape. The different relationships had an appreciable impact on B_o. These differences require further investigation.

Information on natural mortality from life-history based methods indicated a wide range of values that were generally considered to be inconsistent with rockfish life history. However, I could not find this information. This should have been part of the presentation to the Panel.

There may be spatial clines in growth and maturation rates. Ideally, maturation and stock weights at age would be measured annually during surveys, and aggregated in a manner so that the aggregate estimates reflect the stock as a whole. However, such information was not available and the STAT used best practice with the limited information that was available.

Analytical methods – merits and deficiencies

There were two main analytical methods/models used in this assessment: a delta-generalized linear model with mixed effects (delta-GLMM) to provide standardized survey indices, and the SS3 stock assessment model.

The delta-GLMM was based on a post-stratification of survey catches. The post-stratification was based on a variety of criteria that I don't think will cause bias or under-estimation of variance. This is a merit.

Different vessels are used in the NWFSC shelf-slope survey and the delta-GLMM included a random effect for each vessel and year. Many survey groups advocate for comparative fishing experiments when a vessel changes, although my experience here is that unless vessels are really different then there is usually not much difference in catchability if no other survey protocol changes (i.e. same gear, speed, distance, etc.). I gather that for the NWFS shelf-slope survey the vessel skipper is also an important factor affecting catch rates, and this is confounded with vessel/year which is an important reason to include these random effects. This could be meritorious; however, these effects may be confounded with temporal changes in stock abundance and this could be a deficiency. For example, a decrease in abundance in e.g. year y could be accounted for in the model as all negative vessel effects for that year. If all the vessel effects in a year have the same sign then this could indicate a problem.

Another aspect to the delta-GLMM was the addition of a mixture distribution to address extreme catch events (ECE's). Q-Q plots indicated that an ECE error structure was necessary. There was considerable debate about the efficacy of the Q-Q plot approach to model selection, and more research is needed to investigate appropriate goodness-of-fit statistics. The mixture model was not described in much detail and it should be in the future. The model is not commonly used outside of the Pacific region and most reviewers will not be familiar with it.

Another issue with the ECE approach is how to handle age and size composition information collected from such catches. It seems that this was not treated differently for ECE catches compared to other catches, and this is debatable.

Survey abundance indices were calculated using the design-based approach (based on reconstructed strata) and were included in the model data file for comparison. At the STAR Panel review these design-based indices were compared to the delta-GLMM and the results suggested similar trends in stock size.

SS3 models estimates of survey catchabilities (Q's) also made sense.

I am not an SS3 expert, but I concluded from the review meeting that the model was competently applied. The approach seems well suited to dealing with irregularly collected age and length composition information.

A criticism of SS3 is that data inputs are quite dis-aggregated, and as a result the fitting of a variety of model components generates many residuals to examine. It is difficult to 'see the forest through the trees' in all these residuals. I find aggregate level plots such as Figs 55 and 56 are useful for checking higher level model mis-specification. It would be an improvement if confidence intervals could be provided to help assess if differences are outside the range of

variability expected. It seems useful to have some aggregate diagnostic plot for the fits of the length-stratified age compositions.

ToR 3. Evaluate model assumptions, estimates, and major sources of uncertainty.

- Assumption: The population within the coastal waters of the western United States bounded by the U.S.-Canada border on the north and U.S.-Mexico border on the south is treated as a single coastwise stock because of the lack of data suggesting the presence of multiple stocks. Evaluation: This seemed like a reasonable approach; however, the preservation of sub-stock structure should be a management concern, particularly in light of the importance of maintaining spawning components on overall stock productivity.
- Assumption: The modeling period begins in 1916, assuming that in 1915 the stock was in an unfished stochastic (with respect to recruitment deviations) equilibrium condition. Evaluation: Catches were low prior to 1945, and no other ecosystem information was presented to suggest that the stock was not in equilibrium. However, clearly even in the absence of fisheries, fish communities vary in many ways over space and time. Productivity processes (i.e. growth and maturation rates, larval survival, etc.) in virgin stocks may be different than for stocks that have experienced high levels of fishing mortality for a sustained period of time. The conceptual B_o parameter modeled in the assessment is probably much more uncertain than the assessment indicates.
- Assumption: Fishery removals were divided among two fleets: 1) the domestic trawl fishery, 2) bycatch in the foreign POP and at-sea Pacific hake fisheries. Evaluation: The domestic trawl fishery is associated with a particular amount of catch discarded at sea. The bycatch fleets are known not to have discarded much rockfish. Earlier model structures explored splitting the fishery catches into several different fleets, corresponding to trawl and non-trawl gears, at-sea-hake bycatch and the foreign POP fishery removals. However, these fleets had similar selectivity to the trawl fishery. Hence, the treatment of fleets seems reasonable.
- Assumption: A sex-specific model. Separate growth curves are estimated for females and males. Evaluation: the data suggest growth is sexually dimorphic and the model approach is appropriate.
- Assumption: M is fixed for females (M = 0.05) and estimated for males. Evaluation: there is insufficient age data to estimate M freely for males and females; however, fixing M for females means that M can be estimated reliably for males. In exploratory model runs, when M (male/female combined) and the shape of fishery selectivity curve were both estimated, the model was extremely unstable (i.e. was subject to local minima and produced wildly different results based on small differences in model assumptions).
- Estimate: M is higher for males. Evaluation: Growth rates are higher for females so one expects M to be lower for females; hence, the higher M estimate for males makes sense.
- Assumption: Recruitment dynamics are assumed to be governed by a Beverton-Holt stock-recruit function. Evaluation: There was little evidence for a stock-recruit relationship. The

Beverton-Holt model seemed like a reasonable choice; however, there are likely other reasonable choices that could impact the value of B_o. This suggests the model may under-estimate the uncertainty in values for B_o. Recruitment deviations also appeared to have some auto-correlation.

- Assumption: Fixed the value of stock-recruit steepness at h=0.779. Evaluation: I felt this was about as low a value that seemed plausible given the high recruitments that have recently occurred at low levels of SSB. Larger values seemed plausible for the data but perhaps less plausible for rockfish in general.
- Assumption: 'Main' recruitment deviations were estimated for modeled years that had information about recruitment, between 1960 and 2011 (as determined from the bias-correction ramp). Evaluation: I am uncertain about the efficacy of the M-ramp correction. I read the paper but did not fully understand it.
- Assumption: Additional 'early' deviations were estimated between 1870 and 1959 so that age-structure in the initial modeled year (1915) would deviate from the stable age-structure that is consistent with estimated variability in recruitment. This resulted in an estimate of B_o that is also consistent with estimated variability in recruitment given the assumption that initial catch was negligible. Evaluation: Good idea.
- Specification: Length composition data were summarized into thirty 2-cm bins. Age data were summarized into thirty six bins, ranging being age 0 and age 35. Population length bins were 1cm, and age bins were 0-45, with 45 plus group. Evaluation: These seemed like sensible choices. The model did not allow growth to continue in the plus-group.
- Specification: Iterative re-weighting was used in the assessment to achieve consistency between the input sample sizes and the effective sample sizes for length and age composition samples based on model fit. Evaluation: Potentially a good idea.
- Assumption: Weight-at-length parameters for females and males, female maturity-at-length and fecundity-at-length were fixed: Evaluation: A sensible approach for weight-at-length. One could anticipate more temporal variability in female maturity-at-length and fecundity-at-length, but given the lack of available data for Darkblotched rockfish the approach taken by the STAT seemed reasonable. However, future research should investigate these assumptions.
- Specification: Selectivity was modeled as a function of length, using 6 parameter double-normal selectivity curves. Evaluation: Good idea, and better than modeling selectivity as a function of age.
- Specification: The domestic trawl selectivity was fixed to be asymptotic. Evaluation: Good idea. When allowed to be domed, the estimated trawl selectivity was almost asymptotic. It is a good idea to fix this to be asymptotic unless there is convincing evidence that trawl selectivity is domed.
- Specification: A separate retention curve was estimated for the domestic trawl fleet. This retention curve was defined as a logistic function of size. Asymptotic retention was set as a time-varying quantity to match the observed amount of discards between 2000 and 2010. The

base value of asymptotic retention used for the period prior to 2000 and after 2010 was assumed to be 1, since only a small portion of the catch was discarded prior to 2000 and since implementation of the IFQ fishery. Evaluation: More consideration should be given to discarding prior to 2000. Otherwise the approach seemed reasonable.

- Specification: The by-catch fleet selectivity was mirrored to the trawl fleet. Evaluation: Text in the draft assessment document indicated that these fleets had similar selectivity to the trawl fishery. There were issues with weighting the size compositional data for this fleet and it was not used. Hence, there seems to be little alternative to this specification. I have no reason to anticipate that conclusions about stock status will be sensitive to this issue but this should be checked using a sensitivity run.
- Estimates: Selectivity curves for all the surveys were estimated to be strongly dome-shaped. Evaluation: This would normally be a controversial result, but the assessment team was confident that the survey trawls do not sample well large rockfish compared to what the fishery catches.
- Estimates: Survey indices have fairly high standard errors, but model fits to them looked reasonable overall.
- Estimates: Fits to the trawl length compositions were OK; however, I am not sure what would be 'not OK'. The discrepancies between the observed and predicted aggregated (over years) lengths compositions troubled me, and suggested some bias. However, I don't know if these discrepancies are statistically significant.
- Estimates: Fits to the trawl age compositions were also OK. There were also discrepancies between the observed and predicted aggregated (over years) age compositions which trouble me because this could indicate some bias. However, I don't know if these discrepancies are statistically significant.
- Estimates: Fits to the survey length compositions looked OK for both sexes, and the aggregate fits looked better than the trawl age compositions.
- Estimates: Fits to the survey conditional age compositions seemed OK, although there were some discrepancies in some years. It would be useful to provide some type of aggregate diagnostic plot to look for consistent patterns across years.
- Estimates of spawning depletion in the 2000's were consistent with previous assessments.

Summary of changes made in the 2013 SS3 formulation compared to the 2011 formulation:

1. Upgraded to the newest SS version.
2. Updated Washington historical landings and used the recently reconstructed Oregon and California landings.
3. Extended assessment time series back to 1915 (from 1928).
4. Changed the structure of fishing fleets and divided fishery removals between two fisheries (instead of one fleet in 2011 assessment).
5. Treated the NWFSC shelf-slope survey as a single survey time series.
6. Divided AFSC triennial survey into two time-series, 1980-1992 and 1995-2004.

7. Used the newest GLMM software to construct survey abundance indices.
8. Included discard ratio estimates separately for 1985, 1986 and 1987.
9. Used some "early" age data (those read prior to 2004).
10. Extended the 'plus group' in the age data to 35 (from 30).
11. Restructured data length bins.
12. Updated fishery and survey size and age composition data.
13. Updated the maturities and fecundities.
14. Fixed the value of stock-recruit steepness at h=0.779.
15. Extended the estimation of recruitment deviations back in time.
16. Fixed the value for female natural mortality to 0.05 (value was 0.07 in 2011 assessment, both sexes). Estimated M for males.
17. Estimated the extra standard deviations for AFSC triennial and NWFSC shelf-slope survey indices.
18. Employed age selectivity type 11 (to include age-0 fish) in SS3 instead of 10 (that assumes that age 0 fish are not selected).
19. Only fixed fishery selectivity to be asymptotic. In 2011 assessment the NWFSC slope survey was also assumed to be asymptotic.
20. Re-evaluated length-based selectivity blocks after careful analysis of the management actions that are most likely affect length-based selectivity of the fishery.

Sensitivity analyses:

1. Landings and catches
    a. Landings in full time series of domestic trawl fishery doubled.
    b. Landings in full time series of domestic trawl fishery halved.
    c. Landings in historical (pre-1980) time series of domestic trawl fishery doubled.
    d. Landings in historical (pre-1980) time series of domestic trawl fishery halved.
    e. Catches in both fleets (TWL and BYCATCH) doubled.
    f. Catches in both fleets (TWL and BYCATCH) halved.
2. Life history parameters
    a. Used maturity parameters from 2011 assessment.
    b. Used female fecundity parameters from 2011 assessment.
    c. Used weight-length relationship from 2011 assessment.
    d. Used stock-recruit steepness from 2011 assessment.
    e. Used a single growth rate CV parameter for young age (A1) both sexes.
    f. Used a single growth rate CV parameter for old age (A2) both sexes.
    g. Estimated growth rate CV parameter for A2 both sexes.
    h. Ran the model with A1 and A2 as used in 2011 assessment.
    i. Used steepness (0.6) and natural mortality (0.07) from 2007 assessment.
    j. Used low M (0.037) from profile likelihood.
    k. Used high M (0.082) from profile likelihood.

3. Selectivity parameters
    a. Trawl fishery selectivity not fixed to be asymptotic.
    b. NWFSC shelf-slope survey selectivity fixed asymptotic.

Conclusions from sensitivity analyses

1. Sensitivity analyses for landings and catches differed in the absolute estimates of B_o and R_o, but the trends in spawning depletion, and relative SPR ratio as well as estimated depletion levels varied only slightly.
2. a-h: Model results, including trends in spawning output, recruitment, spawning depletion and relative SPR ratio, were nearly identical. **i-k: Resulted in large changes in spawning depletion and relative SPR ratio**.
3. a: Estimated fishery selectivity was essentially asymptotic. Trends in spawning output, recruitment, spawning depletion, relative SPR ratio as well as estimated current depletion levels changed little.
   b: Trends in spawning output, recruitment, spawning depletion, relative SPR ratio as well as estimated current depletion levels were only slightly different.

Little evidence of retrospective patterns was apparent. A retrospective comparison of assessments has indicated similar conclusions about spawning depletion.

Likelihood profile analyses:

1. M with steepness fixed (0.779). Total log-likelihood was approximately flat for M >= 0.05, but increased rapidly for M < 0.05.
2. Steepness with M fixed at 0.05 for both sexes. Total log-likelihood decreased as steepness increased to 1.0.
3. R_o. A minimum in log-likelihood was observed.

ToR 4. Provide constructive suggestions for current improvements if technical deficiencies or major sources of uncertainty are identified.

The STAT responded to several Panel requests for additional analyses. This resulted in an improved stock assessment for Darkblotched rockfish and the Panel concluded that the stock assessment was based on the best available data; the new assessment estimates constitute the best available information on stock status, and are suitable to serve as the basis for fishery management decisions.

I have provided suggestions for improvements under ToR 6, but it would be ill-advised to pursue these in the current assessment schedule and without peer-review.

ToR 5. Determine whether the science reviewed is considered to be the best scientific information available.

I concluded that the SS3 model was competently applied, and the model inputs were derived using best practice. SS3 model assumptions and formulation were appropriate. Depletion estimates during the 2000's were consistent with previous assessments. I conclude that the science reviewed is the best scientific information available at present.

ToR 6. When possible, provide specific suggestions for future improvements in any relevant aspects of data collection and treatment, modeling approaches and technical issues, differentiating between the short-term and longer-term time frame.

Documentation

Better descriptions should be provided of:

1. Ecosystem (biotic and abiotic) changes; e.g. are bottom temperatures warming and if so what could be the implications for species like Darkblotched rockfish?
2. Recruitment dynamics. What controls variations in yearclass strength? Can we expect recruitment immigration from the north which could be included in a stock-recruit model as an intercept at the origin?
3. Input sample sizes for size and age compositions; formulae for these appear with no reference on how they are used in the assessment and only a pers. comm. for reference.
4. Better annual spatial plots of survey catches (larger and fewer per page, i.e. maybe 2x2);
5. Plots of length versus age by sex should be provided. Spatial variability should be investigated; for example, compare plots for at least North and South regions.
6. It would be useful to provide some type of aggregate diagnostic plots for fits to the survey conditional age compositions to look for consistent patterns across years.
7. More detailed figure and table captions. Figure legends were sometimes poorly placed (e.g. Fig. 135).

Input data and analytical methods

1. The lack of length and more particularly age composition information is an important deficiency in this assessment. Darkblotched rockfish is a long lived species and the earliest age data used in the assessment is 1980 for the AFSC shelf survey. The commercial trawl age data covers only 2002-2008. This seems to be the main reason why the assessment is uninformative about how high natural mortality (M) and steepness are. The assessment will likely be improved if additional historical age information, particularly the California ages that have already been estimated, could be incorporated.
2. However, the accuracy of additional historic age information must be investigated first.

3. The fecundity-weight relationships used in the 2011 and 2013 assessments were different, both in terms of scale and to a lesser extent shape. These differences require further investigation.
4. Darkblotched rockfish tend to be found in areas not accessible to the survey trawls but accessible to commercial trawls, and this is a major deficiency with these surveys for rockfish. These surveys seem to provide better indices of juveniles than adults. A reliable fisheries independent survey of adult Darkblotched rockfish will improve the assessment.
5. There may be spatial clines in growth and maturation rates, and studies of these possibilities should be encouraged. Analysis conducted within this assessment detected a continual gradient along the coast in growth parameters, which is common for Sebastes species on the West Coast of the United States. If there are spatial clines in growth rates and maturities then samples should be appropriately weighted so they represent the stock as a whole.
6. In the survey standardization model (delta-GLMM), vessel effects may be confounded with temporal changes in stock abundance. For example, a decrease in abundance in e.g. year y could be accounted for in the delta-GLMM model as all negative vessel effects for that year. I recommend that the predicted vessel effects be examined each time the model is run to make sure that the effects make sense. I would prefer that the vessel effects add to zero each year, unless there is specific evidence to indicate otherwise.

Model assumptions, estimates, and major sources of uncertainty

1. Consideration should be given in future assessments to combining the uncertainty about the alternative 'states of nature' using a prior on M that is consistent with rockfish having similar life history characteristics (e.g. growth and maturation rates) to Darkblotched rockfish.
2. Many stocks have exhibited large changes in maturities over time, perhaps as a response to high total mortality, and this should be investigated for Darkblotched rockfish using annual sampling. There may be a density-dependent element to this since the species is long-lived. This could have implications for the calculation of B_o.
3. Recruitment deviations also appeared to have some auto-correlation which should be investigated. This auto-correlation could be included in medium-term stock projections for decision table analyses.
4. Productivity processes (i.e. growth and maturation rates, larval survival, etc.) in virgin stocks may be substantially different than for stocks that have experienced high levels of fishing mortality for a sustained period of time. The conceptual B_o parameter modeled in the assessment is probably much more uncertain than the assessment indicates. This requires further research.

ToR 7. Provide a brief description on panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations.

An overview was provided that described the data used in the assessment, assessment history, significant changes made in this assessment comparing to the 2007 assessment, and a description of additional analyses requested by the Panel. Discussion by the Panel focused on the model selection criteria for the survey abundance and the implication of the new fecundity and maturity parameters. The recommended base case model after discussion with the STAT included updated maturity and fecundity functions, sex specific M with female M fixed at 0.05 and male M estimated, and steepness of h=0.779.

The STAR panel concluded that the Darkblotched rockfish assessment was based on the best available data, and that this new assessment constitutes the best available information on Darkblotched rockfish off the U.S. west coast. The terminal year depletion rate (SSB2013/SSB0) from the final base model was 36%. Natural mortality was used to bracket the uncertainty in the state of nature.

B. **Petrale Sole**

ToR 1. Become familiar with the draft stock assessment documents, data inputs, and analytical models along with other pertinent information (e.g. previous assessments and STAR panel report when available) prior to review panel meeting.

A draft stock assessment document was provided, including

- a detailed Executive Summary,
- some basic information on stock structure and distribution, basic life history information, and ecosystem information,
- a good description of the history of the Petrale sole fishery off the U.S. west coast, including information on historical catch rates,
- a summary of fisheries off Canada, Alaska, and/or Mexico,
- a summary of fisheries management history and performance off the U.S. west coast,
- fisheries independent survey information (catch rates, length and age compositions),
- other biological information (weight-length relationship, maturity schedule, fecundity, natural mortality, sex ratios, aging bias and precision),
- a detailed description of fishery landings (directed domestic and foreign, and bycatch) discards, and logbooks,
- information on the biological sampling of the catches (lengths, weights, ages),

- a detailed history of stock assessment modeling approaches and responses to the 2011 STAR panel recommendations,
- Assessment model description, including changes made from the last 2011 assessment, model specification (life-history, stock-recruit, fishery and survey selectivity),
- Model selection and evaluation (key assumptions and structural choices, convergence diagnostics, base model results, uncertainty and sensitivity analyses),
- Description of reference points,
- Harvest projections and decision tables,
- Text on regional management considerations,
- Research needs,
- Literature cited, and
- Appendices describing:
    A. Survey post stratification,
    B. Commercial logbook CPUE,
    C. Management actions impacting the Petrale fishery prior to the implementation of the trawl ITQ program,
    D. SS data file,
    E. SS control file,
    F. SS starter file,
    G. SS forecast file,
    H. Fishery age and length composition fits, and
    I. Base model numbers at age.

Previous stock assessment documents

The 2009 and 2011 benchmark assessment documents were provided (see Appendix I) as well as the 2009 and 2011 STAR Panel Meeting Reports. The September 2011 PFMC's SSC Supplemental Report on stock assessments for 2013-2014 groundfish fisheries was provided.

Data input documents

In addition to the information provided in the draft assessment document, additional data input documents provided were the January 2013 "Data Products for Stock Assessment Authors", a NOAA Technical Memorandum describing west coast bottom trawl surveys, and a 2013 document on Oregon's catch reconstruction project.

Documentation on analytical models

In addition to the information provided in the draft assessment document, a documents titled 'Appendix A: Technical Description of the Stock Synthesis assessment program' was provided.

ToR 2. Discuss the technical merits and deficiencies of the input data and analytical methods during the open review panel meeting.

Input data – merits and deficiencies

There is little information regarding the stock structure of Petrale sole off the U.S. Pacific coast although tagging studies indicate they can be highly migratory and can move long distances (350-390 miles). Although this assessment treats the U.S. Petrale sole resource from the Mexican border to the Canadian border as a single coast-wide stock based on two criteria (tagging, no evidence of growth differences), there is clearly a potential for mixing of fish between Canadian and US marine areas.

Landings of Petrale sole rockfish were reconstructed back to 1876, and the assessment assumes a zero catch and equilibrium unfished biomass in 1876. Landings were summarized for a northern fleet consisting of Washington and Oregon and a southern fleet consisting of California. The California and Oregon landings reconstructions represent the best available data on landings in each state. At the time of this assessment, a comprehensive historical catch reconstruction was not available for Washington and they were filled in by interpolating between the years with landings data. While it is meritorious to have such a long time-series of landings, the uncertainty in the landings should be quantified. I did not get a good sense of the quality of the landings data at the STAR Panel review. Foreign landings of this stock are not quantified and some landings in Canada may be from this stock as well.

Data on fishery discards for Petrale sole were sparse and of mostly questionable quality prior to 2001. Year specific discard ratios for the northern fleet were calculated for 1985, 1986 and 1987 from the "Pikitch" study; however, participation in this study was voluntary and discarding practices may be different in that scenario. Since 2001 yearly discard rates and average weight of the discards based on at-sea observer data are available, which is a merit. The discard rates for this time period are low; however, historical (and more questionable) studies seem to indicate higher discard ratios.

Length composition information from landings exists for the period 1949-2012, although the amounts vary by fleet (north and south) and season (winter and summer). Nonetheless this is a long-time series of size composition, which is a merit of the assessment. Age data exist for 1964-2012 (amounts depend on fleet and season) and this long-time series is also a merit.

Sex-specific length data for discards are available for 1986 and 1987 for the northern fleet, and since 2006 (combined sexes) for both fleets and regions. This is limited data. If discard fractions are high then it is important to have size and age information on the discards.

Stock size indices used were:

1. The NWFSC shelf-slope (combo) survey conducted annually since 2003, and including 2013, including sex-specific length and age data.
2. The Alaska Fisheries Science Center'ss (AFSC) triennial shelf survey which was divided into two periods (1980-1992, and 1995-2004) to account for differences in survey timing and depth coverage. Separate catchability coefficients (Q) were estimated for each time period. This seemed like a reasonable choice to me. Sex-specific length compositions were used from this survey, although the sample sizes were low in 1980 and 1983.
3. CPUE during 1987-2009 for the two fleets and regions, although only the winter CPUE indices based on spawning aggregations were used in the assessment model because of the management changes in the summer. The data for 2010-2012 were not included due to restrictions on the Petrale sole fishery due to its overfished status as well as the implementation of the West Coast Groundfish Trawl Catch Share Program.

The NWFSC and AFSC surveys commonly encounters Petrale sole along the U.S. west coast, except south of Point Conception. The temporal coverage of indices is reasonably good. The prevalence and density of Petrale are generally higher in the northern latitudes in the NWFSC survey, but no trend in catch rate was apparent over latitude for the AFSC survey, other than low catch rates in the Conception INPFC area which was only partially sampled.

The weight-length relationship was not updated from the 2011 assessment, but I do not anticipate this is a deficiency.

Petrale sole maturity-at-length information is generally sparse in space and time, has not been collected in a systematic fashion across time, is of varying quality, and does not always agree between studies. It is possible that maturity may have changed over time and/or that it varies spatially. However, it is not possible to assess this quantitatively owing to differences in when historical samples on which maturity ogives could be based were taken, and how maturity stage (visual vs. histological) was determined. The most recent study for the west coast of the U.S. that was based on observations collected during 2002 from Oregon and Washington. This is a deficiency in this assessment, and an unaccounted source of uncertainty. This requires further investigation, particularly in light of the frequently observed decrease in age at maturation that seems to occur when total mortality rates are high.

Ideally maturation and stock weights at age would be measured annually during surveys, and aggregated in a manner so that the aggregate estimates reflect the stock as a whole.

Fecundity (i.e. spawning output) at length figure (i.e. Figure 23) was presented in the draft assessment document, but there was no description of the source of information for this figure. I assume the data is old and I am not sure how reliable it is. This is a deficiency in this assessment, and an unaccounted source of uncertainty.

Information on natural mortality from life-history based methods produced a normal prior distributions for females (mean = 0.151, standard deviation = 0.16) and males (mean = 0.206, standard deviation = 0.218). These priors for M were used in the assessment. I cannot comment on the reliability of this information because the calculations of these priors were not provided. However, they should be reviewed during STAR Panel meetings.

Much work was presented on aging precision and bias and incorporated into the assessment model. This is definitely a merit.

Analytical methods – merits and deficiencies

There were three main analytical methods/models used in this assessment: a delta-generalized linear model with mixed effects (delta-GLMM) to provide standardized survey indices, a Delta-Lognormal model to standardize commercial CPUE data, and the SS3 stock assessment model.

The delta-GLMM was based on a post-stratification of survey catches. The post-stratification was based on spatial and depth distribution criteria that I don't think will cause bias or under-estimation of variance. This is a merit.

Different vessels are used in the NWFSC shelf+slope survey and the delta-GLMM included a random effect for each vessel and year. Many survey groups advocate for comparative fishing experiments when a vessel changes, although my experience here is that unless vessels are really different then there is usually not much difference in catchability if no other survey protocol changes (i.e. same gear, speed, distance, etc.). I gather that for the NWFSC shelf+slope survey the vessel skipper is also an important factor affecting catch rates, and this is confounded with vessel/year which is an important reason to include these random effects. This could be meritorious; however, these effects may be confounded with temporal changes in stock abundance and this could be a deficiency. For example, a decrease in abundance in e.g. year y could be accounted for in the model as all negative vessel effects for that year. If all the vessel effects in a year have the same sign then this could indicate a problem. However, vessel effects were small and varied without trend over time for this stock, which does not indicate a confounding problem

The delta-GLMM included fixed strata*year effects (i.e. a different parameter for each strata and year), whereas in the Darkblotched rockfish assessment the year*strata interaction effects were assumed to be random. The STAT team compared the two approaches for NWFSC shelf+slope catches of Petrale sole and estimates were very similar except in 2004. Hence, this choice of modeling approach does not seem important for this application, which is a merit. However, it would be useful to better understand the relative merits of treating strata*year interactions as fixed or random effects. I suspect this will be more important when there are many strata.

Survey abundance indices were also calculated using the design-based approach (based on reconstructed strata) and were compared to the delta-GLMM and the results suggested similar

trends in stock size. This suggests that further fine-tuning of the delta-GLMM for this stock will not change the resulting abundance indices substantially, which is a merit.

SS3 models estimates of survey catchabilities (Q's) made sense.

The CPUE analyses were improved compared to previous assessments. Overall I was impressed with these analyses. The major changes include

1. calculation of a prediction interval around the CPUE indices,
2. division of fishing grounds into finer spatial grids than the areas used in the 2011 analysis,
3. aggregation of tow by tow data to the trip level (trips are more independent),
4. calculation and inclusion of new covariates to represent changes in fishing tactics over time,
5. and, evaluating the impact of modeling CPUE using a mixed effects model with vessel as the random effect.

Both the summer and winter CPUE indices computed for the 2013 assessment explained a greater amount of the variation in the data than those computed for the 2011 stock. Adjusting for vessel effects is common when standardizing commercial catch rates, but the predicted vessel effects should be examined to see if they make sense. The CPUE prediction intervals seemed very narrow. These were based on a bootstrap procedure that may not include enough of the uncertainty; for example, a principle component analyses (PCA) of species catch compositions was used to generate "targeting" covariates for Petrale sole. The PCA factors were not bootstrapped. These factors are not independent covariates because Petrale sole catches are also used to generate the factors. This requires further research, but I felt that the standard errors provided were too low to be used as input standard errors to SS3.

There was considerable discussion at the STAR Panel about whether there were additional management measures that may affect commercial catch rates. Two possibilities that emerged were the imposition of trip limits in 2006 and a large license buy-back in 2004. Clearly catch cannot always be proportional to effort. At some point fisheries saturate and catch will hardly increase with effort. Hence, the license buy-back may have affected the relationship between catch and effort. Trips limits can have similar effects if fisheries experience in-season local depletion. Additional research is required to further understand the impacts the buy-backs and trip limits might have in the Petrale sole fishery, and also to see if catch rates can be further standardized to remove these impacts. This was not possible or advisable during the STAR panel so the Panel decided to estimate a different CPUE catchability (q) for the 1987-2003 and 2004-2009. I think this was a practical choice necessary to include the CPUE index in the SS3 assessment model.

I am not an SS3 expert, but I concluded from the review meeting that the model was competently applied. The approach seems well suited to dealing with irregularly collected age and length composition information.

A criticism of SS3 is that data inputs are quite dis-aggregated, and as a result the fitting of a variety of model components generates many residuals to examine. It is difficult to 'see the forest through the trees' in all these residuals. I find aggregate level plots such as Figures 94 and 95 are useful for checking higher level model mis-specification. It would be an improvement if confidence intervals could be provided to help assess if differences are outside the range of variability expected. However, for this stock the aggregate fits were very good.

The annual length composition fits should be provided. They were for the commercial data (in Appendix H) but not for the surveys. The Pearson residuals are not easy to interpret and don't necessarily give a good refection of contribution to the NLL fit function.

Some of the Pearson residuals for commercial fleet length compositions indicate larger sized male fish in the north region prior to the early 1980's than the SS3 model predicts. This requires further investigation.

It seems useful to have some aggregate diagnostic plot for the fits of the length-stratified age compositions. I would like plots of aggregate observed versus predicted average length at age.

ToR 3. Evaluate model assumptions, estimates, and major sources of uncertainty.

- Assumption: This assessment treats the U.S. Petrale sole resource from the Mexican border to the Canadian border as a single coast-wide stock based on two criteria (tagging, no evidence of growth differences); however, there is a potential for mixing of fish between Canadian and US marine areas. Evaluation: I can think of no other approach that is currently feasible; however, even within US waters, the preservation of sub-stock structure should be a management concern, particularly in light of the importance of maintaining spawning components on overall stock productivity.
- Assumption: The modeling period begins in 1876 and before this the stock is assumed to be in an unfished stochastic (with respect to recruitment deviations) equilibrium condition. Evaluation: Catches before 1900 were low and no other ecosystem information was presented to suggest that the stock was not in equilibrium. However, clearly even in the absence of fisheries, fish communities vary in many ways over space and time. Productivity processes (i.e. growth and maturation rates, larval survival, etc.) in virgin stocks may be different than for stocks that have experienced high levels of fishing mortality for a sustained period of time. The conceptual B_o parameter modeled in the assessment is probably much more uncertain than the assessment indicates.
- Assumption: Fishery removals were divided among four fleets: north and south combined with winter and summer. Evaluation: A good idea because winter fisheries are on spawning aggregations and summer fisheries are on more dispersed feeding fish, and one might anticipate different selectivity. The availability of size and age data varies for each 'fleet', as

do changes in management regulations that could affect selectivity, which are also good reasons to use the fleet structure proposed.

- Assumption: A sex-specific model. Separate growth curves are estimated for females and males. Evaluation: the data suggest growth is sexually dimorphic and the model approach is appropriate.
- Assumption: M is estimated for females and males, but constant for all ages and years. Normal prior distributions on M for females (mean = 0.151, standard deviation = 0.16) and males (mean = 0.206, standard deviation = 0.218). Evaluation: The priors were not reviewed by the STAR Panel but they seem reasonable. The assumption of age and year invariant M's seems the best decision given the lack of ecosystem information that might indicate otherwise.
- Estimate: M is estimated to be higher for males (0.17) than females (0.15), although not as much as indicated by the priors. Evaluation: Growth rates are higher for females so one expects M to be lower for females; hence, the higher M estimate for males makes sense.
- Assumption: Recruitment dynamics are assumed to be governed by a Beverton-Holt stock-recruit function. Evaluation: There was little evidence for a stock-recruit relationship. Castillo (1992) and Castillo et al. (1995) suggest that density-independent survival of early life stages is low, and this suggests a low steepness. There are also suggestions that environmentally driven recruitment (offshore Ekman transportation of eggs and larvae) variation may be important. The stock recruit plot (Fig. 122 in preliminary draft assessment document) seems to have this type of behavior, with most observations appearing to have a lower value of steepness than estimated (i.e. h = 0.86), but with a smaller number of large recruitments at low stock sizes which could be explained by a few years with much higher early life stage survival than typical. I think it would be interesting to investigate the implications of this type of mixture-model recruitment dynamics; however, I suspect R_o will be poorly defined. In the interim, the Beverton-Holt seemed like a reasonable choice; however, there are likely other reasonable choices that could impact the value of B_o. This suggests the model may under-estimate the uncertainty in values for B_o.
- Assumption: A prior was used for steepness: Normal, mean 0.8 and standard deviation 0.09, with a 75% probability of the range (0.7, 0.9). Evaluation: This prior seemed reasonable.
- Assumption: 'Main' recruitment deviations were estimated for modeled years that had information about recruitment, between 1959 and 2009 (as determined from the bias-correction ramp). Evaluation: I am uncertain about the efficacy of the M-ramp correction. I read the paper but did not completely understand it. Recruitment deviations also appeared to have some auto-correlation.
- Assumption: Additional 'early' deviations were estimated between 1845 and 1958 so that age-structure in the initial modeled year (1876) would deviate from the stable age-structure that is consistent with estimated variability in recruitment. This resulted in an estimate of B_o that is also consistent with estimated variability in recruitment given the assumption that initial catch was negligible. Evaluation: Good idea.

- Specification: The internal population dynamics include ages 0-40, where age 40 is the 'plus-group'. As there is little growth occurring at age 40, the data use a plus group of age 17; there are relatively few observations in the age compositions that are greater than age 17. Evaluation: These seemed like sensible choices.
- Specification: Iterative re-weighting was used in the assessment to achieve consistency between the input sample sizes and the effective sample sizes for length and age composition samples based on model fit. Evaluation: Potentially a good idea.
- Assumption: Weight-at-length parameters for females and males, female maturity-at-length and fecundity-at-length were fixed: Evaluation: A sensible approach for weight-at-length. One could anticipate more temporal variability in female maturity-at-length but given the lack of available data for Petrale sole the approach taken by the STAT seemed reasonable. However, future research should investigate these assumptions.
- Specification: Selectivity was modeled as a function of length (asymptotic, sex specific, with retention curves), although the parametric selectivity models were not described. Evaluation: It is usually better to model selectivity as a function of length rather than age. I was not convinced that sex-specific selectivity and retention curves were required. This could be simplified in future assessments.
- Specification: The commercial fleet and survey selectivity's were fixed to be asymptotic. Evaluation: It is a good idea to fix selectivity's to be asymptotic unless there is convincing evidence for domes. This was explored via sensitivity analyses. Model runs exploring dome-shaped selectivity for the surveys clearly supported asymptotic selectivity. Model runs exploring dome-shaped selectivity for the commercial fleets had convergence problems and produced inconsistent results by sex and fleet. This is not good evidence for domes.
- Specification: Selectivity and retention was modeled in time blocks. Evaluation: Exactly how selectivity varies within time blocks needs better description. Selectivity time blocks were chosen based on changes in fishing practices, the timing of management measures implemented for the groundfish fishery, and the implementation of the trawl ITQ program. Time blocks implemented for fishery retention accounted for management impacts driving changes in discard practices.
- Specification: A power function was used to relate the winter commercial CPUE indices to the population size. Evaluation: It is unclear to me what problem the power function is addressing and how a power function can address this problem. This requires further research.
- Estimates: Survey indices have fairly high standard errors, and the preliminary based model fit to them looked reasonable overall.
- Estimates: The fit to the winter north CPUE was good. Changes were made during the STAR Panel and CPUE catchability was modeled in two time blocks. The fit to the winter south commercial CPUE was strange. The beta parameter was low compared to the initial draft results. This requires further investigation, in particular the efficacy of the power function catchability model.

- Estimates: Aggregate fits to the trawl length compositions were good. Disaggregate (i.e. annual) fits, while more variable, did not suggest serious problems. However, there are some temporal patterns in differences between model and data length compositions for the winter North male catches, and to a lesser extent female catches, that needs further exploration.
- Estimates: Fits to the aggregate trawl age compositions were OK, although there were some discrepancies between the observed and predicted age compositions which trouble me because this could indicate some bias. The observed age-comps tended to be more peaked than the model estimated, especially for males. However, I don't know if these discrepancies are statistically significant. This requires additional research.
- Estimates: Aggregate (over years) fits to the survey length compositions looked good for both sexes. Annual fits, indicated by Pearson residuals, looked OK. However, Pearson residuals can be difficult to interpret and should be augmented with plots of annual observed versus predicted proportions.
- Estimates: Fits to the survey conditional age compositions seemed OK, although there were some discrepancies in some years. It would be useful to provide some type of aggregate diagnostic plot to look for consistent patterns across years.
- Estimates of spawning depletion from this assessment for 2009 and 2011 are similar to estimates from assessments in those years.

Summary of changes made in the 2013 SS3 formulation compared to the 2011 formulation:

1. Upgraded to the newest SS version.
2. Updated priors are used for natural mortality (sex-specific) and steepness.
3. Landings summarized by port of landing rather than area of catch.
4. Combined the Washington and Oregon fleets into a single northern fleet.
5. Use of the Oregon historical landings reconstruction.
6. Use of an early, pre-1990s, age error matrix for surface ages.
7. Addition of data for 2011 and 2012.
8. Two q-blocks for Winter North CPUE (1987-2003 and 2004-2009) to address possible changes in CPUE catchability due to the vessel buy-back program.
9. Added the maximum standard error from the NWFSC survey to input commercial CPUE standard errors and also fixed the extra SE for the NWFSC shelf-slope survey to 0 (the value it would be estimated at if a lower bound of 0 were imposed).
10. Specification of the male growth parameters to be directly estimated rather than estimated as an offset to the female growth parameters (a minor 'housekeeping' change).

Sensitivity analyses:

1. Landings and catches
    a. Landings summarized by port of landing rather than area of catch.
    b. Combining the Washington and Oregon fleets into a single fleet or separate fleets.
    c. Use of the Oregon historical landings reconstruction.

2. Indices
    a. The impact of the 2012 NWFSC survey data on derived model outputs.
    b. Set the NWFSC extra variance parameter to zero.
    c. Added the average standard error (SE) from the NWFSC survey to the input SE for commercial CPUE's and estimated the added SD.
    d. Added the maximum SE from the NWFSC survey to the CPUE input SE's and turned off the estimation of the added SE for the CPUE's.
    e. Revised commercial CPUE indices.
    f. Inclusion of the summer commercial CPUE.
    g. A run with no commercial CPUE.
3. Size and age compositions.
    a. Tuning of composition sample sizes and interaction with the choice of composition lambdas.
    b. Choice of 1 cm versus 2 cm bins for length data.
    c. Commercial age data.
    d. Aging error estimates.
    e. Use of an early, pre 1990s, surface age error matrix compared to a later surface age error matrix.
4. Life history parameters
    a. Estimation of natural mortality.
    b. Estimation of the stock-recruitment steepness.
    c. The tuning of recruitment variability.
    d. The period over which recruitment deviations are estimated.
    e. Specification of the male growth parameters to be directly estimated rather than estimated as an offset to the female growth parameters.
5. Selectivity parameters
    a. Time varying,
    b. combined female and male versus sex specific selectivity,
    c. asymptotic versus dome-shaped selectivity for fishing fleets and surveys,
    d. Time blocking of retention parameters.

Conclusions from sensitivity analyses

1. Results were presented for a run called '2011 catches' and they were very similar to the initial draft base run. I presume this reflects a) and c). Run b was not presented and I presume because it had little impact.
2. a-c): little impact. d,g): SSB depletion decreased from 29% to 22% or 25%. e,f): A run with no winter CPUE was reported, and SSB depletion changed little.

3. The draft base model was most sensitive to removal of the 2012 survey ages, resulting in a slightly lower estimate of h, higher estimate of M, but stock status was estimated to be the same as the base model.
4. a-b) **Spawning depletion and relative SPR ratio** results are sensitive to M and h, and this was illustrated more using likelihood profiles. c-e) Little sensitivity.
5. Results were not presented on combining selectivity's for male and females. The following synopsis was provided.
    - Model runs exploring noontime varying commercial selectivity failed to fit the composition data well.
    - Model runs including time varying selectivity for the commercial fleets as random walks, rather than time blocks as in the base model, had problems converging and poor gradients.
    - Model runs exploring dome-shaped selectivity for the surveys clearly supported asymptotic selectivity.
    - Model runs exploring dome-shaped selectivity for the commercial fleets had convergence problems and poor gradients. They also produced inconsistent results by sex and fleet.

Little evidence of retrospective patterns was apparent. Retrospective comparisons of assessments for 2009 and 2011 have indicated similar conclusions about spawning depletion.

Likelihood profile analyses for draft base model:

1. Natural mortality: Total negative log-likelihood was minimized at female M=0.15 and values in the range of 0.12 to 0.19 were half as plausible (± 1.2 NLL units).
2. Steepness: Total negative log-likelihood was minimized at h=0.87 and values in the range of 0.75 and 1.0 were half as plausible.
3. R_o. A well-defined minimum in log-likelihood was observed.

ToR 4. Provide constructive suggestions for current improvements if technical deficiencies or major sources of uncertainty are identified.

The STAT responded to several Panel requests for additional analyses. This resulted in an improved stock assessment for Petrale sole and the Panel concluded that the stock assessment was based on the best available data; the new assessment estimates constitute the best available information on stock status, and are suitable to serve as the basis for fishery management decisions.

I have provided suggestions for improvements under ToR 6, but it would be ill-advised to pursue these in the current assessment schedule and without peer-review.

ToR 5. Determine whether the science reviewed is considered to be the best scientific information available.

I concluded that the SS3 model was competently applied, and the model inputs were derived using best practice. SS3 model assumptions and formulation were appropriate. Depletion estimates during the 2000's were consistent with previous assessments. I conclude that the science reviewed is the best scientific information available at present.

ToR 6. When possible, provide specific suggestions for future improvements in any relevant aspects of data collection and treatment, modeling approaches and technical issues, differentiating between the short-term and longer-term time frame.

Documentation

Better descriptions should be provided of:

1. Ecosystem (biotic and abiotic) changes; e.g. are bottom temperatures warming and if so what could be the implications for species like Petrale sole?
2. Sensitivity analyses should be documented more completely. Tabulate runs performed, and give main conclusions.
3. Methods and information used to compute priors used for M and h.
4. Input sample sizes for size and age compositions; formulae for these appear with no reference on how they are used in the assessment and only a pers. comm. for reference.
5. Better annual spatial plots of survey catches (larger and fewer per page, i.e. maybe 2x2).
6. Plots of length versus age by sex should be provided. Spatial variability should be investigated; for example, compare plots for at least North and South regions.
7. It would be useful to provide some type of aggregate diagnostic plots for fits to the survey conditional age compositions to look for consistent patterns across years.
8. Provide annual length composition fits should in an appendix.
9. Exactly how selectivity varies within time blocks needs better description.

Input data and analytical methods

1. Growth and maturation rates may vary spatially and temporally, and studies of these possibilities should be encouraged. If there are spatial clines in growth rates and maturities then samples should be appropriately weighted so they represent the stock as a whole.
2. Continue improving historical catch reconstructions (particularly Washington) and assess uncertainty in catch estimates.
3. Investigate further if historical studies on discard ratios can be included in the assessment.
4. Update fecundity at length information.

5. When standardizing trawl survey catch rates, investigate if year*strata interactions should be treated as fixed or random effects. This may include consideration of impacts on index standard errors.
6. Additional research is required to further understand the impacts the buy-backs and trip limits might have in the Petrale sole fishery, and also to see if catch rates can be further standardized to remove these impacts.

Model assumptions, estimates, and major sources of uncertainty

1. Investigate reasons why some of the Pearson residuals for commercial fleet length compositions indicate larger sized male fish in the north region prior to the early 1980's than the SS3 model predicts.
2. Recruitment deviations also appeared to have some auto-correlation which should be investigated. This auto-correlation could be included in medium-term stock projections for decision table analyses.
3. Productivity processes (i.e. growth and maturation rates, larval survival, etc.) in virgin stocks may be substantially different than for stocks that have experienced high levels of fishing mortality for a sustained period of time. The conceptual B_o parameter modeled in the assessment is probably much more uncertain than the assessment indicates. This requires further research.
4. Considering combining some of the sex-specific selectivity and retention curves.
5. It is unclear to me what problem the power function is addressing and how a power function can address this problem. The efficacy of the power function catchability model requires further research.
6. Observed age-comps tended to be more peaked than the model estimated, especially for males. This requires additional research.

ToR 7. Provide a brief description on panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations.

An overview was provided that described the data used in the assessment, significant changes made in this assessment comparing to the 2011 assessment, and a description of additional analyses requested by the Panel. Discussion by the Panel focused on understanding the fishery CPUE standardization and survey GLMM analyses. There were no major changes made to the input data or base model structure. Both the STAT and the panel agreed that minor changes made during the review improved model.

The STAR panel concluded that the Petrale sole assessment was based on the best available data, and that this new assessment constitutes the best available information on Petrale sole off the U.S. west coast. The terminal year depletion rate (SSB2013/SSB0) from the final base model is

22.3%, slightly below the management target of 25%. Natural mortality is used to bracket the uncertainty in the state of nature.

Conclusions and Recommendations

A. Darkblotched rockfish

ToR 1. Become familiar with the draft stock assessment documents, data inputs, and analytical models along with other pertinent information (e.g. previous assessments and STAR panel report when available) prior to review panel meeting.

Conclusions

I found overall that the documentation of the stock assessment inputs, methods, and results were very helpful. As usual for US stock assessments, I found the description of rockfish fisheries and their management, including implications for stock assessments, to be very good. The Executive Summary section and sections that described the implications of changes made from the last assessment and sensitivity analyses were very helpful. The data summary in Figure 7 was very useful – I referred to it many times.

Recommendations

Better descriptions should be provided of:

1. Ecosystem (biotic and abiotic) changes; e.g. are bottom temperatures warming and if so what could be the implications for species like Darkblotched rockfish?
2. Recruitment dynamics. What controls variations in yearclass strength? Can we expect recruitment immigration from the north which could be included in a stock-recruit model as an intercept at the origin?
3. Input sample sizes for size and age compositions; formulae for these appear with no reference on how they are used in the assessment and only a pers. comm. for reference.
4. Better plots of annual spatial plots of survey catches (larger and fewer per page, i.e. maybe 2x2).
5. More detailed figure and table captions. Figure legends were sometimes poorly placed (e.g. Fig. 135).

ToR 2. Discuss the technical merits and deficiencies of the input data and analytical methods during the open review panel meeting.

Conclusions

I concluded that the SS3 model was competently applied, and the model inputs were derived using best practice.

Recommendations

1. The lack of length and more particularly age composition information is an important deficiency in this assessment. It seems to be the main reason why the assessment is uninformative about how high natural mortality (M) and steepness are. The assessment will likely be improved in this regard if additional historical age information, particularly the California ages that have already been estimated, could be incorporated. However, I recognize that the accuracy of this information must be investigated first.
2. Darkblotched rockfish tend to be found in areas not accessible to the survey trawls but accessible to commercial trawls, and this is a major deficiency with these surveys for rockfish. These surveys seem to provide better indices of juveniles than adults.
3. There may be spatial clines in growth and maturation rates, and studies of these possibilities should be encouraged.
4. In the survey standardization model (delta-GLMM), vessel effects may be confounded with temporal changes in stock abundance. For example, a decrease in abundance in e.g. year y could be accounted for in the delta-GLMM model as all negative vessel effects for that year. I recommend that the predicted vessel effects be examined each time the model is run to make sure that the effects make sense. I would prefer that the vessel effects add to zero each year, unless there is specific evidence to indicate otherwise.

ToR 3. Evaluate model assumptions, estimates, and major sources of uncertainty.

Conclusions

SS3 model assumptions and formulation were appropriate. Depletion estimates during the 2000's were consistent with previous assessments.

I agree with the stock assessment that Darkblotched rockfish was at 36% of its unexploited level in 2013. This is above the overfished threshold of SB25%, but below the management target of SB40% of unfished spawning output.

The profile likelihood analyses demonstrate that the assessment data and model are uninformative about how large M may be, and indicate that steepness is high. The sensitivity analyses demonstrated that important assessment results are sensitive to M and steepness. This is

clear in the decision table. Because M was fixed at 0.05 for females in the assessment model, probability intervals for spawning output and depletion do not reflect the real uncertainty about these 'states of nature'.

Recommendations

1. In future assessments, consideration should be given to combining the uncertainty about the alternative 'states of nature' using a prior on M that is consistent with rockfish having similar life history characteristics (e.g. growth and maturation rates) to Darkblotched rockfish.
2. There are indications that Darkblotched rockfish life history parameters, particularly those related to growth, might vary with latitude. Analysis conducted within this assessment detected continual gradient along the coast in growth parameters, which is common for Sebastes species on the West Coast of the United States. This requires further research. If there are spatial clines in growth rates and maturities then samples should be appropriately weighted so they represent the stock as a whole.
3. Many stocks have exhibited large changes in maturities over time, perhaps as a response to high total mortality, and this should be investigated for Darkblotched rockfish using annual sampling. There may be a density-dependent element to this since the species is long-lived. This could have implications for the calculation of B_o.
4. It would be useful to provide some type of aggregate diagnostic plots for fits to the survey conditional age compositions to look for consistent patterns across years.
5. Recruitment deviations also appeared to have some auto-correlation which should be investigated. This auto-correlation could be included in medium-term stock projections for decision table analyses.

ToR 4. Provide constructive suggestions for current improvements if technical deficiencies or major sources of uncertainty are identified.

I have provided suggestions for improvements under ToR 6, but it would be ill-advised to pursue these in the current assessment schedule and without peer-review.

ToR 5. Determine whether the science reviewed is considered to be the best scientific information available.

The science reviewed is the best scientific information available at present, and this new assessment constitutes the best available information on Darkblotched rockfish off the U.S. west coast.

ToR 6. When possible, provide specific suggestions for future improvements in any relevant aspects of data collection and treatment, modeling approaches and technical issues, differentiating between the short-term and longer-term time frame.

These are provided under ToR's 1-3.

ToR 7. Provide a brief description on panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations.

Recommendations

Updated assessment documents following the STAR Panel review should be provided on the Pacific Fishery Management Council's ftp site.

B. **Petrale Sole**

ToR 1. Become familiar with the draft stock assessment documents, data inputs, and analytical models along with other pertinent information (e.g. previous assessments and STAR panel report when available) prior to review panel meeting.

Conclusions

I found overall that the documentation of the stock assessment inputs, methods, and results were very helpful. As usual for US stock assessments, I found the description of fisheries and their management, including implications for stock assessments, to be very good. I appreciated the historical information on fishery performance; it agreed with the model output which gave me additional confidence in the assessment. The Executive Summary section and sections that described the implications of changes made from the last assessment and sensitivity analyses were very helpful. The data summary in Table 3 was very useful – I referred to it many times.

Recommendations

Better descriptions should be provided of:

1. Ecosystem (biotic and abiotic) changes; e.g. are bottom temperatures warming and if so what could be the implications for species like Petrale sole?
2. Sensitivity analyses should be documented more completely. Tabulate runs performed and give main conclusions.
3. Methods and information used to compute priors used for M and h.
4. Input sample sizes for size and age compositions; formulae for these appear with no reference on how they are used in the assessment and only a pers. comm. for reference.

5. Better annual spatial plots of survey catches (larger and fewer per page, i.e. maybe 2x2).
6. Plots of length versus age by sex should be provided. Spatial variability should be investigated; for example, compare plots for at least North and South regions.
7. It would be useful to provide some type of aggregate diagnostic plots for fits to the survey conditional age compositions to look for consistent patterns across years.
8. Provide annual length composition fits should in an appendix.
9. Exactly how selectivity varies within time blocks needs better description.

ToR 2. Discuss the technical merits and deficiencies of the input data and analytical methods during the open review panel meeting.

Conclusions

I concluded that the SS3 model was competently applied, and the model inputs were derived using best practice.

Recommendations

1. Growth and maturation rates may vary spatially and temporally, and studies of these possibilities should be encouraged. If there are spatial clines in growth rates and maturities then samples should be appropriately weighted so they represent the stock as a whole.
2. Continue improving historical catch reconstructions (particularly Washington) and assess uncertainty in catch estimates.
3. Investigate further if historical studies on discard ratios can be included in the assessment.

ToR 3. Evaluate model assumptions, estimates, and major sources of uncertainty.

Conclusions

SS3 model assumptions and formulation were appropriate. Depletion estimates during the 2000's were consistent with previous assessments.

I agree with the stock assessment that Petrale sole was at 22% of its unexploited level in 2013. This is slightly below the management target of 25%. The stock was not overfished in 2012. The 2012 1-SPR is 60% which is less than the 1-SPR-based management fishing mortality target of 70%.

Recommendations

1. Investigate reasons why some of the Pearson residuals for commercial fleet length compositions indicate larger sized male fish in the north region prior to the early 1980's than the SS3 model predicts.

2. Growth and maturation rates may vary spatially and temporally, and studies of these possibilities should be encouraged. If there are spatial clines in growth rates and maturities then samples should be appropriately weighted so they represent the stock as a whole.
3. Considering combining some of the sex-specific selectivity and retention curves.
4. The efficacy of the CPUE power function catchability model requires further research.
5. Observed age-comps tended to be more peaked than the model estimated, especially for males. This requires additional research.
6. It would be useful to provide some type of aggregate diagnostic plots for fits to the survey conditional age compositions to look for consistent patterns across years.
7. Recruitment deviations also appeared to have some auto-correlation which should be investigated. This auto-correlation could be included in medium-term stock projections for decision table analyses.

ToR 4. Provide constructive suggestions for current improvements if technical deficiencies or major sources of uncertainty are identified.

I have provided suggestions for improvements under ToR 6, but it would be ill-advised to pursue these in the current assessment schedule and without peer-review.

ToR 5. Determine whether the science reviewed is considered to be the best scientific information available.

The science reviewed is the best scientific information available at present, and this new assessment constitutes the best available information on Petrale sole off the U.S. west coast.

ToR 6. When possible, provide specific suggestions for future improvements in any relevant aspects of data collection and treatment, modeling approaches and technical issues, differentiating between the short-term and longer-term time frame.

These are provided under ToR's 1-3.

ToR 7. Provide a brief description on panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations.

Recommendations

Updated assessment documents following the STAR Panel review should be provided on the Pacific Fishery Management Council's ftp site.

Appendix 1: Bibliography of materials provided for review

Draft and Background Documents
Stock Assessment Review Panel for Petrale Sole and Darkblotched Rockfish

Meeting Materials:

STAR Panel Meeting Agenda

List of Participants Stock Assessment Review Panel for Petrale Sole and Darkblotched Rockfish

Terms of Reference for the Groundfish and Coastal Pelagic Species Stock Assessment and Review Process for 2013-2014. Pacific Fishery Management Council. November, 2013.

Draft Stock Assessment Documents

DRAFT Status of the U.S. Petrale sole resource in 2013. Melissa A. Haltuch, Kotaro Ono, and Juan Valero. April, 2013.

DRAFT Status of the Darkblotched rockfish resource off the continental U.S. Pacific Coast in 2013 . Vladlena Gertseva and James T. Thorson. 04/27/2013.

Background Materials

Data Products for Stock Assessment Authors. NWFSC Observer Program (a.k.a.WCGOP). 2013. *8Jan. 2013.*

Development of prediction intervals and priors for the natural mortality rate using multiple meta-analyses using life-history correlates. Owen S. Hamel. NOAA Fisheries, Northwest Fisheries Science Center, Seattle. 4/28/2013.

Estimating a Bayesian prior for steepness in Pacific rockfishes (*Sebastes* spp.) off the U.S. West Coast for the 2013 assessment cycle. James Thorson. April 1, 2013.

Petrale Sole Stock Assessment Review (STAR) Panel Report, Hotel Deca, Seattle, Washington. 20-24 June 2011.

Status of the U.S. Petrale sole resource in 2010. Melissa A. Haltuch, Allan Hicks, and Kevin See. 23 November, 2011.

Petrale Sole STAR Panel Report. May 4-8, 2009
Status of the U.S. Petrale sole resource in 2008. Melissa A. Haltuch and Allan Hicks. 17 November, 2009.

Scientific and Statistical Committee Report on Stock Assessments for 2011-2013 Groundfish Fisheries. PFMC, SSC. June, 2009.

Scientific and Statistical Committee Report on Stock Assessments for 2013-2014 Groundfish Fisheries. PFMC, SSC. June, 2011.

Scientific and Statistical Committee Report on Stock Assessments for 2013-2014 Groundfish Fisheries. PFMC, SSC. September 2011.

Scientific and Statistical Committee Report on Stock Assessments for 2013-2014 Groundfish Fisheries. PFMC, SSC. November, 2011.

Status and Future Prospects for the Darkblotched Rockfish Resource in Waters off Washington, Oregon, and California in 2011. Andi Stephens, Owen Hamel, Ian Taylor and Chantel Wetzel. November, 2011.

Status and Future Prospects for the Darkblotched Rockfish Resource in Waters off Washington, Oregon, and California as Updated in 2009. John R. Wallace and Owen S. Hamel. June 24, 2009.

Darkblotched Rockfish STAR Panel Meeting Report. July 16-20, 2007.

Status and Future Prospects for the Darkblotched Rockfish Resource in Waters off Washington, Oregon, and California as Assessed in 2007. Owen S. Hamel. January 24, 2008.

Historical Reconstruction of Oregon's Commercial Fisheries Landings. Mark Karnowski, Vladlena Gertseva, and Andi Stephens . September, 2013.

Documentation of the California Catch Reconstruction Project. Stephen Ralston, Donald Pearson, John Field, and Meisha Key. April 20, 2009.

DRAFT -Applying the U.S. West Coast's First Major Trawl Bycatch and Mesh Size Studies to Fishery data using Post-hoc Fishing Strategies and Geographical Area. John R. Wallace. Accounting for space-time interactions in index standardization models. James T. Thorson and Eric Ward.

<u>Additional Materials Provided During the Panel</u>

Stock Synthesis User Manual
Stock Synthesis Technical Description

Thorson, J.T., Stewart, I.J., and Punt, A.E. 2013. Development and application of an agent-based model to evaluate methods for estimating relative abundance indices for shoaling fish such as Pacific rockfish (Sebastes spp.). ICES Journal of Marine Science, 69(4), 635–647. doi:10.1093/icesjms/fss003.

Thorson, J.T., Stewart, I.J., and Punt, A.E. 2011. Accounting for fish shoals in single- and multi-species survey data using mixture distribution models. CJFAS – Proof.

Thorson, J.T. and Ward, E.J. *In press.* Accounting for space-time interactions in index standardization models.

Appendix 2: CIE Statement of Work

Attachment A: Statement of Work for Marine Institute of Memorial University of Newfoundland (Dr. Noel Cadigan)

External Independent Peer Review by the Center for Independent Experts

Stock Assessment Review (STAR) Panel for Darkblotched rockfish and Petrale Sole

Scope of Work and CIE Process: The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Technical Representative (COTR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

Project Description: A benchmark assessment will be conducted for Darkblotched rockfish, a species declared overfished and currently managed under a rebuilding plan. The 2013 assessment update encountered dramatic changes in stock structure, as observed by the west coast bottom trawl survey. A benchmark assessment is needed to re-evaluate and resolve assessment issues related to these changes and their relationship to stock-recruit steepness.

A benchmark assessment will be also be conducted for Petrale sole, a species declared overfished and currently managed under a rebuilding plan. A benchmark assessment is required to accommodate a restructuring of the model's catch data. It is also expected that the 2013 assessment will indicate that the stock has been rebuilt.

Assessments for these two stocks will provide the basis for the management of the groundfish fisheries off the West Coast of the U.S. including providing scientific basis for setting OFLs and ABCs as mandated by the Magnuson-Stevens Act. The technical review will take place during a formal, public, multiple-day meeting of fishery stock assessment experts. Participation of external, independent reviewer is an essential part of the review process.

The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

Requirements for CIE Reviewers: Two CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. One of the CIE reviewers will participate in all STAR panels held in 2013, except for the than Pacific hake, to provide a level of consistency between the STAR panels. The reviewers shall be active and engaged participants throughout panel discussions and able to voice concerns, suggestions, and improvements while respectfully interacting with other review panel members, advisors, and stock assessment technical teams. The CIE reviewers shall have excellent communication skills in addition to working knowledge and recent experience in fish population dynamics, with experience in the integrated analysis modeling approach, using age-and size-structured models, use of MCMC to develop confidence intervals, and use of Generalized Linear Models in stock assessment models. Each CIE reviewer's duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein.

Location of Peer Review: Each CIE reviewer shall conduct an independent peer review during the panel review meeting scheduled in Seattle, Washington during the dates of 13-17, May 2013.

Statement of Tasks: Each CIE reviewers shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein.

Prior to the Peer Review: Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer information (full name, title, affiliation, country, address, email) to the COTR, who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the background documents, reports, foreign national security clearance, and other information concerning pertinent meeting arrangements. The NMFS Project Contact is also responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

Foreign National Security Clearance: When CIE reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for CIE reviewers who are non-US citizens. For this reason, the CIE reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: http://deemedexports.noaa.gov/sponsor.html).

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review

documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review. Documents to be provided to the CIE reviewers prior to the STAR Panel meeting include:

- The current draft stock assessment reports;
- Previous stock assessments and STAR Panel reports for Darkblotched rockfish and Petrale sole;
- The Pacific Fishery Management Council's Scientific and Statistical Committee's Terms of Reference for Stock Assessments and STAR Panel Reviews;
- Stock Synthesis (SS) Documentation
- Additional supporting documents as available.
- An electronic copy of the data, the parameters, and the model used for the assessments (if requested by reviewer).

Panel Review Meeting: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. **Modifications to the SoW and ToRs can not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COTR and CIE Lead Coordinator.** Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, and their peer review tasks shall be focused on the ToRs as specified herein. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewers as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in Annex 2.

Other Tasks – Contribution to Summary Report: Each CIE reviewer may assist the Chair of the panel review meeting with contributions to the Summary Report, based on the terms of reference of the review. Each CIE reviewer is not required to reach a consensus, and should provide a brief summary of the reviewer's views on the summary of findings and conclusions reached by the review panel in accordance with the ToRs.

Specific Tasks for CIE Reviewers: The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Participate during the panel review meeting in Seattle, Washington during the dates of 13-17 May 20113.

3) In Seattle, Washington during the dates of 13-17 May 2013 as specified herein, and conduct an independent peer review in accordance with the ToRs (**Annex 2**).
4) No later than 31 May 2013, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and to Dr. David Die, CIE Regional Coordinator, via email to ddie@rsmas.miami.edu. Each CIE report shall be written using the format and content requirements specified in Annex 1, and address each ToR in **Annex 2**.

Schedule of Milestones and Deliverables: CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

April 8, 2013	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
April 29, 2013	NMFS Project Contact sends the CIE Reviewers the pre-review documents
May 13-17, 2013	Each reviewer participates and conducts an independent peer review during the panel review meeting
May 31, 2013	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
June 14, 2013	CIE submits CIE independent peer review reports to the COTR
June 21, 2013	The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director

Modifications to the Statement of Work: Requests to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the COTR within 10 working days after receipt of all required information of the decision on substitutions. The COTR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

Acceptance of Deliverables: Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COTR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COTR (William Michaels, via William.Michaels@noaa.gov).

Applicable Performance Standards: The contract is successfully completed when the COTR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:
(1) each CIE report shall completed with the format and content in accordance with **Annex 1**,
(2) each CIE report shall address each ToR as specified in **Annex 2**,
(3) the CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

Distribution of Approved Deliverables: Upon acceptance by the COTR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COTR. The COTR will distribute the CIE reports to the NMFS Project Contact and Center Director.

Support Personnel:

William Michaels, Program Manager, COTR
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Key Personnel:

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Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Summary of Findings for each ToR in which the weaknesses and strengths are described, and Conclusions and Recommendations in accordance with the ToRs.

   a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including providing a brief summary of findings, of the science, conclusions, and recommendations.

   b. Reviewers should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.

   c. Reviewers should elaborate on any points raised in the Summary Report that they feel might require further clarification.

   d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.

   e. The CIE independent report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.

3. The reviewer report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of the CIE Statement of Work
   Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Annex 2: Terms of Reference for the Peer Review

Stock Assessment Review (STAR) Panel for Darkblotched rockfish and Petrale Sole

1. Become familiar with the draft stock assessment documents, data inputs, and analytical models along with other pertinent information (e.g. previous assessments and STAR panel report when available) prior to review panel meeting.
2. Discuss the technical merits and deficiencies of the input data and analytical methods during the open review panel meeting.
3. Evaluate model assumptions, estimates, and major sources of uncertainty.
4. Provide constructive suggestions for current improvements if technical deficiencies or major sources of uncertainty are identified.
5. Determine whether the science reviewed is considered to be the best scientific information available.
6. When possible, provide specific suggestions for future improvements in any relevant aspects of data collection and treatment, modeling approaches and technical issues, differentiating between the short-term and longer-term time frame.
7. Provide a brief description on panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations.

Annex 3: Tentative Agenda

Final Agenda to be provided two weeks prior to the meeting with draft assessments and background materials.

Stock Assessment Review (STAR) Panel for Petrale Sole and Darkblotched Rockfish

Silver Cloud University Inn
5036 25th Avenue NE,
Seattle, WA 98105

May 13-17, 2013

Monday, May 13, 2013

8:30 a.m.	Welcome and Introductions
9:15 a.m.	Review the Draft Agenda and Discuss Meeting Format (T. Tsou, Chair) - Review Terms of Reference (TOR) for assessments and STAR panel - Assign reporting duties - Discuss and agree to format for the final assessment document - Agree on time and method for accepting public comments
9:30 a.m.	Presentation of Darkblotched rockfish Assessment (V. Gertseva) - Overview of data and modeling
12:30 p.m.	Lunch (On Your Own)
1:30 p.m.	Q&A session with Darkblotched rockfish STAT
	STAR Panel discussion - Panel develops written request for additional model runs / analyses
3:30 p.m.	Presentation of Petrale sole Assessment (M. Haltuch) (if time allows) - Overview of data and modeling
5:30 p.m.	Adjourn for Day.

Tuesday, May 14, 2013

8:30 a.m.	Continue Presentation of Petrale sole Assessment (M. Haltuch) - Overview of data and modeling
12:00 p.m.	Lunch (On Your Own)
1:30 p.m.	Q&A Session with Petrale sole-STAT
	Panel Discussion - Panel develops written request for additional model runs / analyses
4:30 p.m.	Check in with Darkblotched rockfish -STAT
5:30 p.m.	Adjourn for Day.

Stock Assessment Review (STAR) Panel for Petrale Sole and Darkblotched Rockfish

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Wednesday, May 15, 2013

8:30 a.m. Presentation of First Set of Model Runs for Darkblotched (V. Gertseva)
- Q&A session with the Darkblotched -STAT & Panel discussion
- Panel develops written request for second round of model runs / analyses for Darkblotched -STAT

12:00 p.m. Lunch (On Your Own)

1:30 p.m. Presentation of First Set of Model Runs for Petrale sole (M. Haltuch)
- Q&A session with Petrale sole -STAT & Panel discussion
- Panel develops written request for second round of model runs / analyses for Petrale sole -STAT.

5:30 p.m. Adjourn for day.

Thursday, May 16, 2013

8:30 a.m. Presentation of Second Set of Model Runs for Darkblotched
- Q&A session with the Darkblotched -STAT & Panel discussion
- Agreement of preferred model and model runs for decision table
- Panel continues drafting STAR report.

12:00 p.m. Lunch (On Your Own)

1:00 p.m. Presentation of Second Set of Model Runs for Petrale sole
- Q&A session with the Petrale sole -STAT & Panel discussion
- Agreement of preferred model and model runs for decision table
- Panel continues drafting STAR report.

4:00 p.m. Continue Panel Discussion or Drafting STAR Panel Report

5:30 p.m. Adjourn for day.

Friday, May 17, 2013

8:30 a.m. Consideration of Remaining Issues
- Review decision tables for assessments

10:00 a.m. Panel Report Drafting Session

12:00 p.m. Lunch (on your own)

2:00 p.m. Review First Draft of STAR Panel Report

4:00 p.m. Panel Agrees to Process for Completing Final STAR Report by Council's June Meeting Briefing Book Deadline (May 29th)

5:30 p.m. Review Panel Adjourn.

Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Participants
Stock Assessment Review Panel for
Petrale Sole and Darkblotched Rockfish

Silver Cloud University Inn
5036 25th Avenue NE,
Seattle, WA 98105
Phone: (206) 526-5200
May 13-17, 2013

Technical Reviewers
Tien-Shui Tsou, Scientific and Statistical Committee (SSC), Panel Chair
Yan Jiao, Center for Independent Experts (CIE)
Noel Cadigan, Center for Independent Experts (CIE)
Ian Stewart, International Pacific Halibut Commission

Panel Advisors
John DeVore, Pacific Fishery Management Council (PFMC), Staff Officer
Rob Jones, PFMC Groundfish Management Team (GMT)
Pete Leipzig, PFMC Groundfish Advisory Subpanel (GAP)

Stock Assessment (STAT) Teams
Petrale Sole STAT
Melissa Haltuch, Northwest Fisheries Science Center
Kotaro Ono, University of Washington
Juan Valero, Center for the Advancement of Population Assessment Methodology

Darkblotched Rockfish STAT
Vladlena Gertseva, Northwest Fisheries Science Center
James Thorson, Northwest Fisheries Science Center